THE SERVICE CHARGE—HOW CONSTITUTED[1]

By J. N. Chester

This paper may be regarded as a discussion of, or reply to, the report of the Committee on Meter Rates of the New England Water Works Association which has appeared during the last two years in the *Proceedings* of that Association; it is also a revision of a paper read by the author before the Pennsylvania Water Works Association at Atlantic City last October.

A well known author has defined the Service Charge, as "A Form of minimum charge made to cover the cost incurred by the utility in holding itself in constant readiness to render service without, however, delivering a single unit of service." Another author states that, "A popular fallacy regarding the ready-to-serve expense, is that it is limited to merely the meter or service line, which is far from the truth, as the ready-to-serve feature embraces the entire plant and extends back through the whole utility organization."

The Meter Rate Committee of the New England Water Works Association appears to have fallen into the pit pointed out by the authors above quoted, for they state that the service charge is made up as follows:

> First, the average amount of money invested by the works in the service pipe and meter.
>
> Second, the cost of reading meters, keeping of meter records, making out bills and collecting the money.
>
> Third, an amount which will represent the approximate average value to the works of the water that passes a domestic meter without being registered.

This confines the charge, with the exception of the addition for leakage, to the meter and service line only.

What constitutes a service charge and the ways of determining it naturally create a broad field for difference of opinion. The New England Committee in determining the ratios used in the discussion, started with areas of circles the same as meter sizes, which it tem-

[1] Read before the Four-State Section at Philadelphia on April 18, 1917.

pered with the ratio of the carrying capacities, as well as the maximum normal output of meters, and it arrived at nearly the same ratios as the author, wherein he started with the diameter of the service pipe and the meter, tempered this with the normal capacity of meters, the loss of head in service pipe, meter, and orifice of influx, as shown in the following table:

Relative demand of service lines and meters. Service lines assumed at 100 feet long from street main to center of maximum demand

Diameter of service pipe / Size of meter	½″ ½″	¾″ ¾″	¾″ 1″	1″ 1″	1¼″ 1¼″	2″ 2″	3″ 3″	4″ 4″	6″ 6″
Type of meter	Disc meters					Rotary meters			
Capacity in gallons per minute	4	7	8	13	30	40	75	125	200
Capacity in gallons twenty-four hours	5,760	10,080	11,520	18,720	43,200	57,600	108,000	180,000	288,000
Loss of head in feet:									
Service pipe	27.00	19.00	25.00	19.00	11.00	6.60	2.92	1.85	0.58
Meter	7.00	16.00	3.00	2.30	5.00	6.00	8.07	7.00	4.60
Orifice of influx	0.34	0.20	0.27	0.22	0.23	0.13	0.09	0.07	0.04
Total loss of head	34.34	34.20	28.27	21.52	16.23	12.73	11.08	8.92	5.22
Relative demand	1.00	1.75	2.00	3.25	7.50	10.00	18.75	31.25	50.00

The relative final results as to ratios obtained by the author and the New England Committee are

	SIZE OF METER	NEW ENGLAND	AUTHOR
	inches		
One-half inch service	⅝		1.00
Three-fourths inch service	⅝	1.0	1.75
	¾	1.7	2.00
	1	3.0	3.25
	1½	6.0	7.50
	2	10.0	10.00
	3	20.0	18.75
	4	30.0	31.25
	6	60.0	50.00

With this ratio established, the New England Committee proceeded to build up the service charge for a ⅝ inch meter as follows:

In the above tabulation the $\frac{3}{4}$-inch service is used in conjunction with the $\frac{5}{8}$- and $\frac{3}{4}$-inch meters only; with all other meters the size service intended by the author should be the same diameter as the size meter given.

"First, 10 per cent of the average investment of the works in the service pipe and meter.

Second, $1 per annum for reading meters, billing, and collecting.

Third, $2 per annum for the probable value of unregistered water.

For a domestic service charge with $\frac{5}{8}$ inch meter, the ordinary service charge may properly be $3 when the service and meter are paid for by the taker; $4 when the meter is furnished by the works; and $5 or $6 where both meter and service pipe are paid for by the works; the lower figure being used where the average cost of the service pipe is under $15 and the higher where it is greater than $15."

The service charge for larger size meters naturally is obtained by multiplying that found for the $\frac{5}{8}$ inch size by the factors above given.

In the author's opinion, the New England Committee has established but a portion of the service charge, which might, with the exception of unregistered water, properly be styled the consumer charge, and he believes the service charge should be constituted of a consumer charge and a capacity charge, and that unregistered water should be accounted for in the output charge.

The consumer's charge may be defined as being made up of the cost which accrues to the plant due to each separate consumer, such as reading meter, repairing the meter and service line if owned by the utility, interest on the meter and service line, the keeping of accounts and making out, mailing and collecting bills.

The capacity charge should, in total for all consumers, including public and private fire protection, be the amount necessary to keep the plant ready for service and intact were not a drop of water delivered for the entire year, necessarily including interest on the fair investment and depreciation on the entire physical plant.

The cost of producing service, together with maintenance and profits, should be incorporated in the output charge, which will be discussed later.

Whether we constitute the service charge of one thing or another and regardless of what elements may enter into this makeup, the burden of this paper is to show, if possible, that the amounts set forth in the report of the New England Committee as ordinary proper service charges are inadequate, except in extreme cases, or at the best represent possible minimum amounts applicable in extraordinary cases only.

A reply to this assertion may be that whatever the service charge produces, the balance must be made up by the output charge,

which of course is the intention of any service charge. But the author believes the New England Committee neglected the fact that in many places the revenue from output charge is extremely variable and unstable, and unless it becomes the major source of income, it will too frequently occur, due to the ups and downs of prosperity, wet seasons and other causes too numerous to mention, that the revenue will at times become inadequate to meet the requirements expected of it.

Let it therefore be understood, that in the author's opinion, the function of the service charge is more to stabilize than to produce a revenue, which might all come from an output charge, if revenue so obtained was stable from year to year.

FIRE PROTECTION

Public. It has been stated before that the service charge included public fire protection. That the rate for this may be fixed by any of the methods above discussed is not claimed. Whatever the method of determining what the charge for public fire protection shall be, it should place the proper proportion of that burden on the vacant lot as well as the improved property, encourage the installation of a sufficient number of hydrants, and prevent, in the case of privately owned plants, the ordering by the municipality served of long lines of pipe without compensation.

Private. It is the author's opinion that the service charge should cover private fire protection only to such extent as the hazard thereby incurred to the water company shall warrant, the excess over this being distributed to a per sprinkler-head, per hydrant or per nozzle charge. The author hopes to see the day when this charge shall be tempered by the hazard.

OUTPUT CHARGE

The output charge may be defined as that part of the burden due to the cost of operating the plant, which includes fuel, supplies, maintenance other than depreciation, and salaries to more or less extent in controversy. The oft repeated statement that the proper return having been obtained through a service charge, the entire output may be sold at a fixed price unit, is, in nine cases out of ten, a fallacy, permissible only in districts where consumers are wholly residents or domestic. Even then it is open to question. The

nearer consumers are located with respect to the pumping station, the lower the cost at which they can be served. This would point toward a zone system of charges, varying with each foot the consumer is distant from the means of introducing the water into the mains. Each consumer who resides higher than the lowest consumer costs the water company more to produce the pressure necessary to render him good service; so, again, the rate should increase with every increase in elevation above the means of introducing the water into the distributing system.

Such refinement, however, would introduce endless complications and so common practice has ordinarily decreed that within a certain district, all consumers supplied by one pressure at the source or means of introducing water to the distributing system, shall be accorded the same rate.

In the output charge, a variation should be made and in this, in most cases, quantity consumed should govern price per unit of service.

To forestall attacks from the advocate of the principle that no water should be sold below cost, it may be stated that cost is susceptible of different interpretations and should be looked upon from the standpoint that a large consumer is profitable at any rate which produces a result that will add to the net revenue of the plant, even though the rate is below the average cost as built up by administration, operating, depreciation, interest and profit.

The principle adopted by many rate makers of first determining the high or unit price for small quantities to small consumers is wrong, and the minimum output unit price or charge to the largest consumer should be first determined. The following are a few axioms observed by the author in casting output charges.

A community with few or no industrial consumers may have but a single output charge.

Communities where a water supply is universally accessible to large consumers demand either a high service charge or an extremely variable output charge.

In casting a variable output charge the lowest unit price should be the maximum that conditions will permit, and the higher the low price is fixed the lower the high price.

Usually a railroad or some large mill or factory is the consumer to receive the low price, and his ability to produce his own supply and the cost at which he can obtain it is not only the feature that must

govern as to whether or not he is a consumer, but at what price the company or municipality can afford to furnish him a supply. This should be a trifle more than the unit price at which he can provide his own. Once this low price is fixed, the next larger consumer generally give less trouble, and the probable revenue from large consumers is soon ascertained. This total is subtracted from the whole amount to be derived from output charge, and the remainder can then be distributed to the commercial and domestic or small consumers in a consistent manner.

A few recently adjudicated service and output charges will serve to illustrate.

SIZE OF OPENING	BEAVER VALLEY, PA.‡	CITY WATER CO., SEDALIA, PA.	OHIO VALLEY WATER COMPANY, BELLEVUE
½ inch or ⅝ inch tap*	$4.60		
½ inch or ⅝ inch tap†	9.00	$6.00	$6.00
¾ inch tap	13.00	9.60	9.00
1 inch tap	24.00	12.00	15.00
1½ inch tap	48.00	30.00	30.00
		1¼″ 18.00	
2 inch tap	100.00	48.00	50.00
3 inch tap	200.00	90.00	110.00
4 inch tap	380.00	120.00	200.00
		5″ 168.00	
6 inch tap	840.00	240.00	440.00

* One opening only.
† More than one opening.
‡ Based on diameter of tap in main.

Output charge

	per 1000 gallons
Beaver Valley:	
For the first 1,000,000 gallons per annum	$0.10
For the next 9,000,000 gallons per annum	0.08
For all over 10,000,000 gallons per annum	0.06
City Water Company, Sedalia, Mo.:	
For the first 30,000 gallons per month	0.30
For the next 100,000 gallons per month	0.20
For the next 200,000 gallons per month	0.15
For the next 1,000,000 gallons per month	0.10
For all over 1,330,000 gallons per month	0.075
Ohio Valley:	
For all water used	0.12

The decision in the Ohio Valley case outlined the following:

Fair return, 7 per cent	$64,732.08
Annual operating expenses	63,500.00
Annual depreciation, ¾ of 1 per cent	6,935.58
Gross revenue	$135,167.66

This gross revenue to be collected by the company as follows:

From fire service	$27,035.53
From all other service	108,134.13

This last item was to be the sum of the service and the output charges, which, strange to say, applied to 1916 conditions, produced the following:

Output charge	$59,319.48
Service charge	40,824.23
Municipal and miscellaneous consumption	7,990.42
Total	$108,134.13

It might be also noted that it divides the revenue, other than fire protection, at approximately 60 per cent from output and 40 per cent from service charge.

The Beaver Valley rates were cast to produce a gross revenue of $135,950, of which $25,000 was set apart for public fire protection, and the remaining $110,950 was ordered distributed on the basis of 60 per cent for readiness to serve and 40 per cent for output.

A comparison between the ready-to-serve charge and private fire protection rates for different size openings imposed by the Beaver Valley decision may interest. They are as follows:

	DOMESTIC	FIRE
1½ inch	$48.00	$50.00
2 inches	100.00	75.00
4 inches	380.00	100.00
6 inches	840.00	175.00
8 inches		300.00

Sedalia, Mo., is a city where water is difficult to obtain. They have but two large industrials, the shops of two railroads centering there.

DISCUSSION

J. W. LEDOUX: The author has given a very valuable address on service charge, and the speaker is in entire accord with most of his conclusions. One point, which is very important, is that the service charge which should include a charge for fire protection and should be equal to the expense to the water company when no water is delivered to the consumer. This charge should be prorated on some such basis as the author outlined, the size or capacity per minute of the service pipe, or meter.

In his justification of selling water to large consumers below cost, the author must have in mind the condition where a company has an unlimited supply and it does not run any risk in selling a portion of this water below cost. The speaker's experience has generally been under conditions where the supply was limited, and even in cases where water has been taken from large lakes, the intake pipe and works have been so expensive to construct and maintain that the effect was practically to make the supply a limited one. Therefore, if the water company can sell its entire supply for, say, 10 cents per thousand gallons, and it has not yet reached its maximum obtainable revenue with its present plant, is it justified in selling a portion of its water for say 5 cents per thousand gallons? Beginnings are dangerous. When once a low rate is established for a water-works, the pressure is so great to maintain it as normal that the water company gets into serious trouble later, when, on account of encroachment on its supply or unprofitable business, it attempts to raise this rate. Under any circumstances, contracts at such low rates should be for short periods, and such consumers should be given clearly to understand that the water is being sold below cost on account of there being a surplus at that time.

The author makes use of a term engineers should avoid not only openly but in spirit. . He says, certain rates should be based on what the "traffic will bear." It would be better to state, "the rates should be what the traffic should bear." Water companies should always act fairly with their patrons for two reasons, first, because it is just to do so, and second, it is better policy. It is of great commercial value to a water company to have a reputation for square dealing.

G. S. CHEYNEY: The previous speaker took exception to the author's statement, that certain rates should be based upon what the traffic will bear. As a matter of policy, no doubt, the suggestion that this term be avoided is good, as the use of this phrase appears to excite the public, the newspapers and the commissions very much like a red flag excites a bull.

"What the traffic will bear" appears to be generally accepted to mean the exploiting of the purchaser. It is curious that this interpretation of the term is generally accepted. In practice it has been just the opposite, and what the traffic will bear has been the consumer or shipper's greatest argument in securing rates such as they desired. The very basic thought of the principle is a rate which will create or develop the business and not one which will hamper or interfere with development. It is the principle which gives the greatest protection to the buyer, as it prevents rates being fixed which he could not afford to pay and in former times, before the days of commissions, it was practically the only principle considered in rate making. It is safe to say that 75 per cent of existing rates which are lower than warranted to bring a fair return on the value of the property, were originally made on this principle. In most cases it was sound business, as it enabled the company to develop the business which would increase its gross receipts without making a corresponding increase in its operating expenditures.

The courts and commissions are apparently very loath to openly admit that the value of the service, or what the traffic will bear, is a proper matter for consideration in rate making, and they go through considerable pretense of basing rates on the value of the property devoted to the service, but it is quite apparent to any one who follows these cases that what the consumer can afford or is willing to pay is the matter of predominating importance and practically governs rate making by these bodies. No commission or court would make a rate so high that it would prevent the purchaser buying, even though such a rate was required to produce a fair return on the investment, as shown by all the evidence and records before them. Such a rate would, of course, be an absurdity, as it would bankrupt the company.

If what the traffic will bear, or the value of the service, is not to be considered in rate making, the shipper, consumer or purchaser can have no logical place at a rate hearing before a court or commission, for otherwise the only matter to be determined would be a

fair return on the value of the property devoted to the service, and what the consumer or shipper could afford to pay would not be competent evidence.

Apparently the fundamental difficulty in rate making by governing bodies is that they are trying to ride simultaneously these two horses. The first is the old well-known steed, endorsed by the Supreme Court, known as "a fair return on the value of the property devoted to the service." This is a horse designed by man on a somewhat scientific plan. The second is a practical horse, sired by necessity and working on the theory that payment should be based upon the value of the service, or the price at which the seller and the buyer are willing to trade. This latter principle governs all commercial operations which are not publicly controlled and must ultimately govern the rate making by these bodies also, as a rate which is either too high or too low, as measured by this standard, will ultimately bankrupt the company. If too high it will "kill the goose that lays the golden egg," and if too low, the company will not secure sufficient revenue to meet its fixed expenditures.

"What the traffic will bear" will, like the poor, be with us always, whether we like it or not, but it may sound more pleasant to rechristen this and call it by a name which will sound better to the public. P. T. Barnum discovered many years ago that the "public like to be fooled," and there are no indications of humanity having changed in this respect.

ALLEN HAZEN: The paper on the service charge is a timely and welcome addition to the discussion of meter rates. The New England Water Works Association has recently adopted a standard form of meter rates. This followed the work of a committee extending over several years and a discussion of the proposed rates in preliminary form by members of the Association at several meetings. It is to be hoped that the author's paper is the beginning of a wider discussion, with a view to the ultimate general adoption throughout the United States of a uniform schedule of meter rates.

Among the suggestions that the author makes is one that a greater proportion of the whole annual budget should be carried by the service charge, and a smaller amount in the price per thousand gallons or output charge. He suggests particularly that such a transfer be made of that part of the budget which represents the capital charges on the supply works.

The division of the whole cost of service between the service charge and the output charge is, in the end, a matter of judgment. The proportion of distribution is also a matter of broad general policy. There is no one system of calculation or estimate which can be said to be always right. It is to be noted that the form of schedule adopted by the New England Water Works Association does not fix in any way this proportion, but leaves the matter entirely open to be fixed for each system, as may be thought best. The author's suggestion thus relates to a method of calculation suggested by the committee as a helpful one, and does not apply to the form of rate that has been adopted by the Association.

Taking up the author's proposition as it relates to these methods, the writer believes that there are two fundamental reasons which, in a majority of cases, will make it inadvisable to carry out to the full extent the proposed transfer.

The first reason is that if the matter is carried out to its logical conclusion, it puts too large a burden on the smallest takers. The writer thinks that the method of calculation proposed by the committee for reaching service charges puts about all the load on the smallest consumers that the business will stand, and he also believes that the method puts all the load upon them that is their fair share. About half of the whole number of takers in an average system use less than 100 gallons per day each. Ninety per cent of all the takers, including these, are supplied by $\frac{5}{8}$-inch meters. The service charges are graded according to the size of meter. No distinction in service charge is made between the smallest takers and the largest domestic takers using $\frac{5}{8}$-inch meters. When the service charge is considerably increased, both the smallest takers and the larger ones pay the same advance. As a matter of fact, the larger domestic takers ought to have their service charges increased more than the smaller ones. The most practical way of doing this is to grade the service charge according to the amount of output. To do this can only be accomplished by increasing the charge per thousand gallons, while keeping the amount of service charge within a limit that is not unreasonable from the standpoint of the smallest takers. This the committee has tried to do by fixing a service charge in such a way that there will be no probable loss in maintaining the service to any taker.

It may be that the service charge could be wisely increased somewhat above this limit in cases, but the writer raises the question

whether it is not a fact that increasing it to a substantial amount will put a load on the smallest takers that is not warranted and that is not just to them.

The second reason why the capital charges should not be transferred to the service charge is somewhat different in its nature. To justify this transfer it must be supposed that the works are provided throughout of adequate size to supply any quantity of water that will be required. This condition may be reached in a plant when it is first built and for a certain period thereafter, but some time it will be necessary to enlarge the supply works. When that time comes, or even when it is approached, and thereafter, it must be considered that the supply works are, or should be, larger than otherwise necessary for the purpose of taking care of the larger consumers.

In an ordinary water supply system, the wholesale takers use a very substantial proportion of the whole output. The primary function of the water works is to supply the domestic needs of a community and they are mostly represented by the smaller takers. Extensions of the supply works are primarily needed to take care of the larger or wholesale takers.

The investment of capital in works to supply increasing output is just as necessary to the business as paying operating costs. The annual charges on capital so invested are just as much a part of the cost of supplying water as are the operating costs. There may be exceptions, but the writer believes that ordinarily all of the capital charges on the supply works should be carried as part of the cost per thousand gallons of the water that is supplied.

J. N. CHESTER: Replying to Mr. Ledoux's criticism on the author's stand regards selling water to large consumers below cost, Mr. Ledoux should have made his statement read "below average cost." Wherein he says the author must have in mind conditions where a water company has an unlimited supply, the argument intends metered service, and where all consumers are metered it is difficult to conceive of the water supply being less than the demand. If it is not sufficient, an expenditure should immediately be made to so create it, and this expenditure should be taken into consideration in figuring the average cost and also in ascertaining whether or not the consumer adds to the net revenue. On the other hand, if the existence of a low-rate consumer using water in quantities jeopar-

dizing the sufficiency of the supply and the estimated cost of providing to meet the wants of this consumer will greatly increase the fixed charges, this consumer's rate, or the lower output rates, should be at once adjusted on the basis of the increased fixed charges, and if he remains a permanent consumer, the plant should be at once put into condition to meet the demand.

The author is pleased with Mr. Chesney's staunch support of the phrase "all the traffic will bear," but deferring to the criticism of Mr. Ledoux and numerous others, the author has changed this to read "the maximum that conditions will permit."

As for Mr. Hazen's argument that the plan of imposing a material portion of the burden on the ready-to-serve charge puts too large a proportion on the smallest takers, he is asked to reflect that "you cannot keep your cake and eat it." Unless a just proportion of the burden is placed on the smallest takers, the revenue will, at time of depression when the industrial and commercial use is frequently more than cut in two, in so far as a fair return is concerned, be found wanting, or in other words, the output revenue in prosperous times must not be taken as a criterion for the minimum years. Even the average of a number of years is an unsafe reliance, and the author's final opinion is that the rate of return can only be made stable through the medium of the service charge, which naturally warrants a lower output charge but thereby begets a larger number of consumers.

Both Messrs. Ledoux and Hazen apparently cling to the idea that a rate once established or a large consumer taken on at a low rate becomes a fixture to remain and under some conditions becomes burdensome. Not so from the author's standpoint. Under public utility regulation a new rate may be filed at any time that it is justified, and large consumers should always be given to understand that their rate is subject to change at any time that it may be found unprofitable.